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WEST VIRGINIA

AGRICULTURAL EXPERIMENT STATION

Apples.

L. C. CORBETT.

DECEMBER, 1896.

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1897.

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WEST VIRGINIA

AGRICULTURAL EXPERIMENT STATION

Morgantown, W. Va.

APPLES.

West Virginia, because of its location in the Appalachian Mountain System, possesses a climate which renders it capable of becoming a formidable rival in the production of fruits in general, and particularly apples, pears, peaches and raspberries.

The mountains push the northern flora well down toward the southern boundary of our state, thus providing, upon the lower hills and in the valleys, those conditions of atmosphere, rainfall and temperature conducive to the growth of northern plants, such as the fruits above mentioned.

The experience of every orchardist and fruit grower of the state will bear me out in the statement that there are thousands of acres of cleared land in West Virginia which today are paying little or no dividend, that if planted in apples or small fruits, and intelligently cultivated, would produce an income not inferior to that obtained from the orange groves of Florida. Although we can hardly ask for better evidence, we are not dependent upon the limited experience of fruit growers of this region. Prof. C. Hart Merriam, of the U. S. Dept. of Agriculture, gives us a basis for determining not only the distribution of animals and plants in general, but in that area denominated

by him the "Upper Austral Zone" we have outlined the general boundaries of the valuable fruit producing regions of the country.

Through the kindness of Prof. Merriam we are enabled to reproduce the map published in the Year Book of the Department of Agriculture for 1894. From this—noting the extent and position of the "Upper Austral Zone"—the great fruit producing regions of northern, central and western United States are easily traced. The eastern and northern distribution is seen to take its origin in Massachusetts and Connecticut, then to go northward up the Hudson River Valley; from there it follows the eastern slope of the Allegheny Mountains southward to northern Georgia and Alabama, where it again takes a northern trend, following closely the trend of the mountains, thus covering a small portion of eastern West Virginia, and a much larger area in the western part of the state; leaving only the loftier mountain chains outside the limits of the area of profitable fruit culture.

To give a clearer conception of the extent of this area a map of our state has been prepared and is presented on page 120, from which it may be seen how little of the state, comparatively speaking, lies outside of this region.

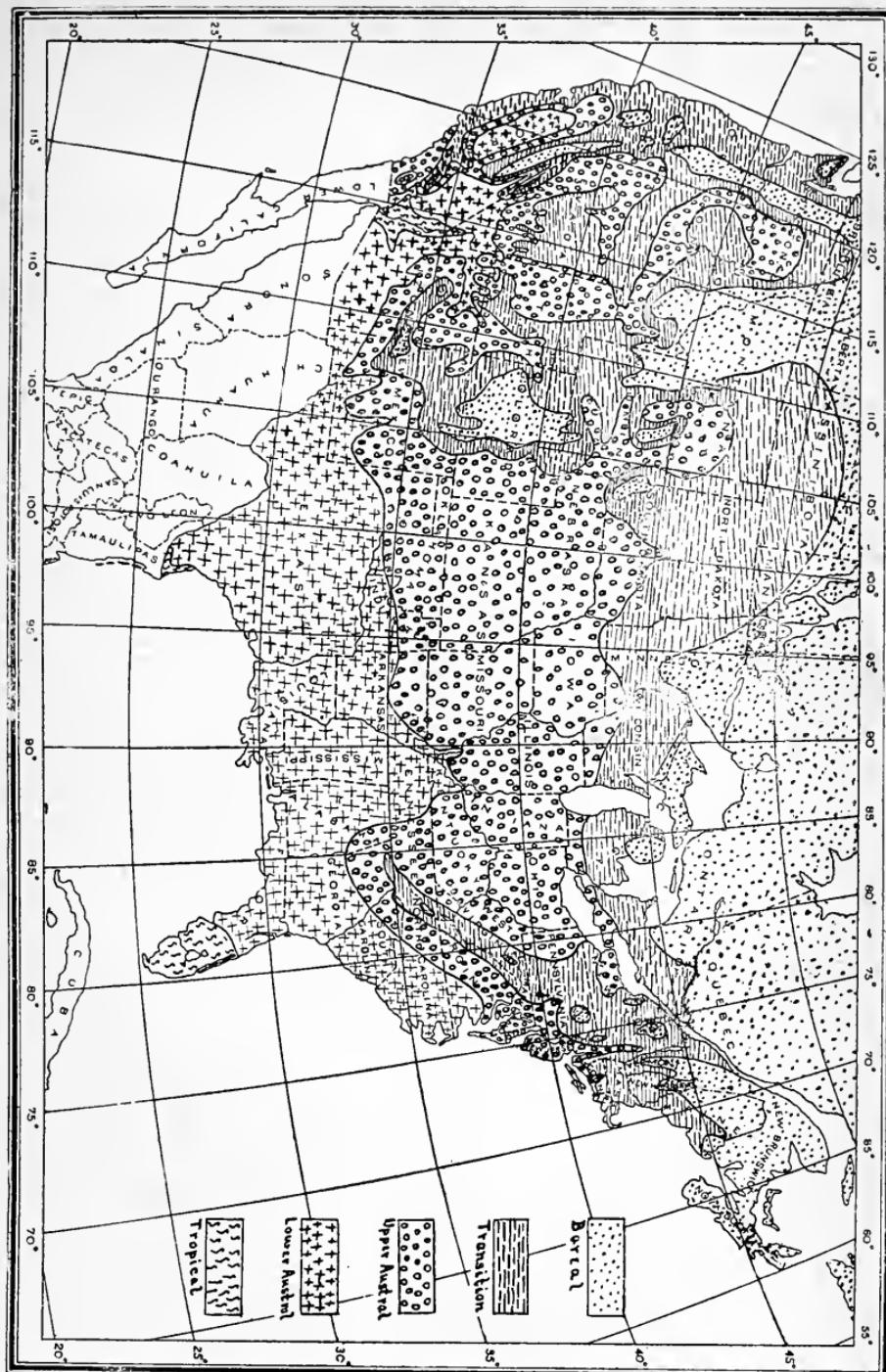
The orchard and berry patch will, if well cared for, produce a much more liberal reward for time and labor expended than can be expected from cereal crops upon the same land.

Our soil, as well as climate, is well suited to the production of fruits, and as there is only a comparatively limited portion of the continental area of the globe adapted to the production of orchard and small fruits, we are only acting wisely when we take advantage of our natural resources. By withdrawing from competition with the great Northwest in the production of cereals, especially wheat, we are ridding ourselves of the one great drain upon the fertility of our soil.

By encouraging and developing the fruit interests of the state we call in co-ordinate industries along other lines. For the shipment of apples barrels are demanded, and we have in

By kindness of Prof. Hart Merriam, U. S. Dept. Agr.

LIFE ZONE MAP OF THE UNITED STATES.



our second growth timber a supply of material that can be used in this industry.

Then, too, if there is a demand and market for this second growth timber, we have at once created a reason for more careful management of our growing forests, as well as a reason for maintaining in forests such areas as are unprofitable for agricultural and horticultural operations.

In this connection I wish to direct the reader to one or two common mistakes which have been very generally committed by those who have planted orchards. This misfortune, as we may now consider it, has not fallen more heavily upon West Virginia than upon many other states. It is the fault of planting a large collection of varieties in small orchards, thus reducing the quantity of any one variety below a profitable limit. This plan of making an orchard a miniature Experiment Station for private education and pleasure can no longer be advocated. Fruit growing is not a pastime for the gratification of the eye and palate merely, but it is a profession, or one of the specialties of agriculture which is governed by the same rules as any other paying business, and, to be made remunerative, the same forethought and care must be exercised as in other commercial operations.

It is a day of large concerns, of concentration, if you please, and the fruit grower must make fruit growing his specialty and give it his best thought and energy. Orchards should be composed of fewer varieties and better ones. Not those possessing high flavor merely, but those having good market qualities, i.e., good color, size and a firm texture, with as high flavor as is attainable in that variety under careful management and upon good soil.

This idea of many varieties in each orchard was to a degree admissible in the early plantations, but to-day there is no reason for it. The early orchardist was compelled by the necessities of the case to make his own test of sorts suited to his soil and exposure. These problems have long since been settled, and now we are to turn our energies to the profitable production of the highest grade fruit. This can only be accomplished

by putting into practice those forces which have been found of late years to be so necessary to the production of a perfect specimen of any variety of fruit. First, the tree should be carefully selected from the nursery, then intelligently pruned at planting time, the soil having been well prepared by previous cultivation and cropping. After the tree is once established in its permanent home, care should be exercised to prevent it from feeling a lack of any one of the essential elements of plant growth, and when it shall have come to bearing age the extra demands upon its vital force must not be forgotten; extra allowances of potash and phosphoric acid should be supplied in order to prevent premature dropping of the foliage, imperfect ripening and under-size of the fruit. While much can be done by cultivation and fertilization to increase the length of life in trees, the splitting and breaking down of the limbs under heavy loads of fruit or during heavy winds can only be obviated or prevented by careful attention to pruning at planting, and from that time on until the tree has reached a mature bearing age. There is perhaps no operation connected with the successful management of an orchard which requires greater experience and skill than the operation of pruning, yet it is not unfrequently left to novices and boys, who, instead of acting as the careful and conscientious surgeon does for the good of his charge, act rather as a butcher or destroyer, thus leaving the plant in a condition even less fitted to bear a profitable crop of fruit than when nature was given her own course. Many persons, for reasons supposedly of a humane order, discourage pruning, but the experienced orchardist and fruit grower knows only too well the result of neglect, or of giving nature her own course. An orchard is not a natural plantation, and trees growing under the high culture of modern orchard practice cannot be treated as trees in a natural thicket or forest. Trees standing at some distance apart, as in an orchard, are not subjected to the competition which exists between trees growing in forests, and thus natural pruning, so often noted in forest growths, is entirely eliminated.

The problem of orchard fertilization is at present one of the

questions that for our own state demands more than the usual amount of attention. In the fruit regions of the northeastern United States this problem is reduced to a question quite different from that encountered here. All the northern and eastern states are covered with a soil that is the result of glacial action, with a drift soil in the valleys. This drift is largely composed of organic matter, and is rich and retentive. In our own state we have no soil that is the result of glacial action. Our uplands are entirely clothed with sedentary soil of a clayey or gravelly nature, depending upon the nature of the rock strata from which it has been derived. The lowlands and river valleys, while containing a transported soil, present a very different character from similar formations in the glacial region. Our-bottom lands are sandy, porous, quick but not retentive soils. For orchards situated in this sandy region quite a different course must be pursued from that practiced in like plantations upon the elevated sections. It is also probable that decided differences will be noted in the varieties adapted to these different soil formations. At this time the problem of orchard nourishment can only be hinted at; it will, however, form one of the subjects for future study, and will receive careful attention from this department. In fact, tree nourishment and tree spraying are the two questions of importance in the apple growing portions of this state.

THE ORCHARDS OF NORTHERN WEST VIRGINIA.

Perhaps no state in the union possesses a greater acreage of apple trees within the limit of so small a region as does West Virginia. This industry has spread within the last thirty-five years over several thousand acres of that portion of Hancock county bordering the Ohio River. Beginning across the river from Wellsville, Ohio, the orchards extend in an almost unbroken belt for upwards of six miles along the river slope, and back to the table lands, a distance of from one to two miles. Within this area of twelve square miles there are probably not far from 2,500 acres of young or bearing apple trees.

Such an industry has not been the growth of a day, but has slowly evolved, and to-day requires the entire attention of

those most largely engaged in the business. Other farm operations are of secondary consideration, and are engaged in merely for the purpose of reducing the cost of maintaining the necessary labor and power for the farm, for even in an intensive industry like that here carried on, garden products in quantity and feed for teams can be more cheaply produced upon the farm than it can be purchased from hucksters or gardeners. The apple industry, however, is the all absorbing industry. Throughout the year apples are the source of the main portion of the work of this region. During the winter sorting and grading the fruit, together with tree pruning in the early spring months, require the employment of a large force of skilled labor. One advantage of these intensive forms of agriculture lies in the continuous employment of labor. This is of advantage to the laborer as well as the employer. Skill in pruning, picking and assorting fruit is a matter of experience and practice, the same as skill in any other profession. A man who has become proficient in these several lines of work, and who is acquainted with the methods of the grower, as well as the location and peculiarities of the several orchard blocks, is obviously of much greater value to his employer than any man who has yet to learn any or all of them. The trained man or the skilled man is cheaper for the farmer, the same as the skilled mechanic is for the manufacturer. True it is that proprietors have not given this question as much attention as it justly deserves, but the tendency is now in the right direction.

The Soil. The soil of the apple region of Hancock county is for the most part of two sorts—a gravelly clay loam on the hillsides, and a sandy loam on the river bottoms. In the outset nearly all the orchards were planted upon the hillsides or uplands, but at present the industry holds the highest rank in importance, and trees are no longer set on the waste ground, but upon the best soil the farm affords. It is something of a question, in my mind, whether or not the plantations on this sandy soil are likely to maintain their producing powers to the extent that those on the higher grounds have. If no drawback

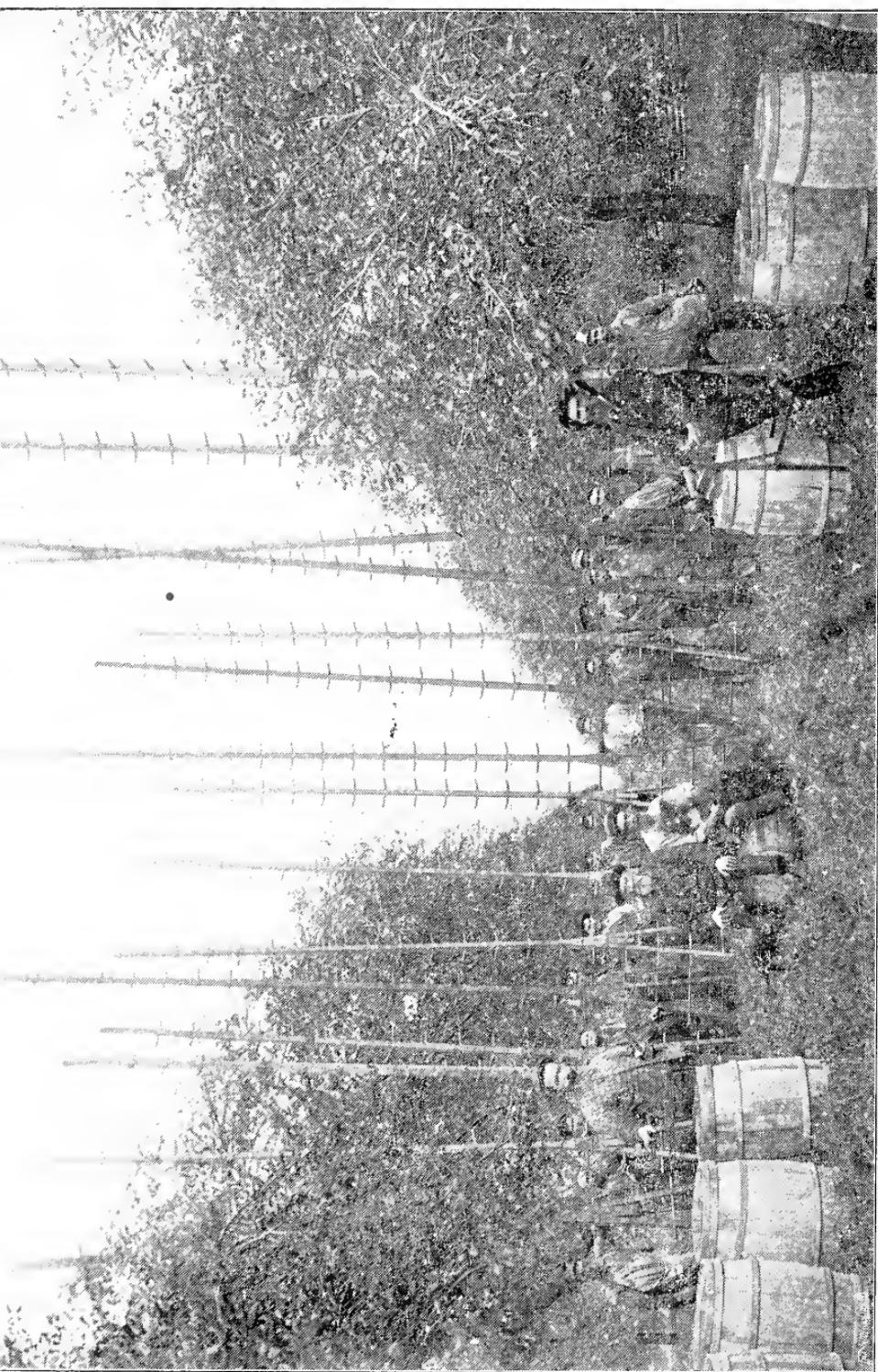
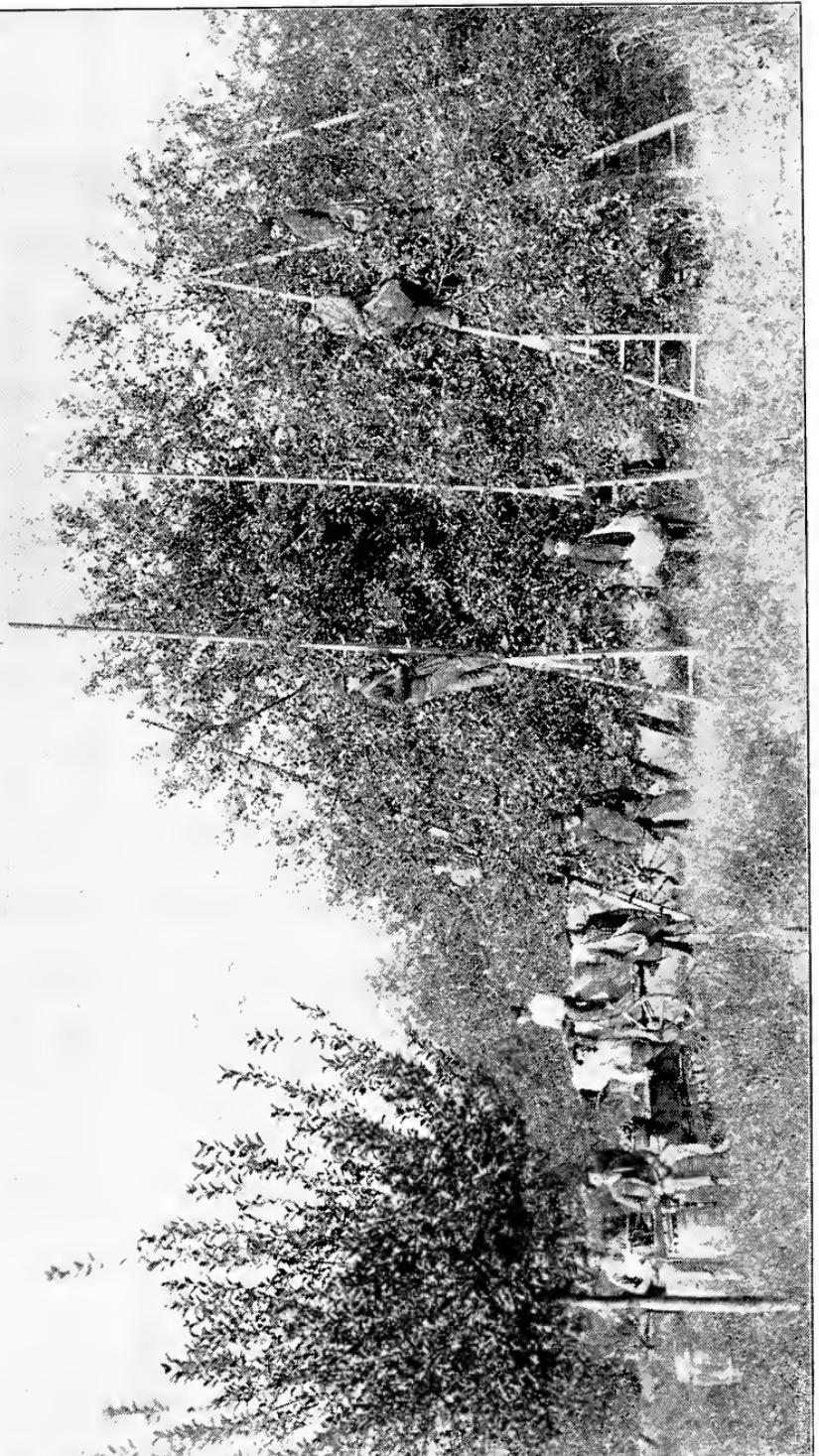


PLATE XI.—A Group of Apple Pickers at Wm. F. and Robt. Brown's, Hancock Co., W. Va.

Fig. 11. Cider mill, Foothills, Hancock Co., W. Va. (Note Ladders and Picking Sacks used.)



of this sort demonstrates itself then there is a decided advantage in the level land for the orchard, so far as the ease and comfort with which the regular work of cultivation and harvesting can be carried on. The low ground forces the tree more rapidly during the years immediately following planting, causing a rank growth of wood and foliage, but at the same time somewhat retards the period at which the tree commences bearing.

It is also evident that trees on the sandy bottom lands require more fertilizing than those grown on the higher and more retentive soil. As a general rule, too, trees growing on the more elevated areas, while somewhat more liable to injury from late spring frosts, at the same time possess a greater immunity from frost than trees in shallow runs, or at the head of hollows or draws where the aerial drainage is less complete. All lands situated in the river valley or upon the slopes bounding it, possess almost complete air drainage.

Distance to Plant Trees. In general, not enough space is given an apple tree. Growers imagine that trees standing 30 to 32 feet apart each way are given ample space. This is true for the first 18 or 20 years, but after that the low branches will interfere with spraying and harvesting, and the whole plantation is rendered too dark and damp to allow of the highest development of color and flavor. Not less than 40 feet each way should be allowed for the full development of the trees and convenient space for working.

Care of the Fruit. The care of the fruit is the most expensive matter connected with the apple industry. A large force of skilled pickers is required, for the growers desire to let the fruit remain as long upon the trees as it can be safely allowed to and yet escape freezing. The longer the fruit remains upon the trees during the cool nights and bright sunny days of October, the more highly the color and flavor becomes developed, and the greater the size of the fruit. A force of pickers in one of the large orchards of Hancock county is shown in Plates XI and XII. The men are distributed so that there are two or three to a tree. They are required to pick the fruit clean

from the tree and to deliver it to the packers free from leaves and twigs. The usual custom is to pay the pickers not by the day, but by the barrel. The price varies, according to the character of the work and the privilege given the workmen, from 6 to 8 cents per barrel. Thirty barrels a day is considered a day's work, although an expert can, under favorable circumstances, gather 70 to 80 barrels in a day. The fruit is seldom sorted as it is taken from the tree, unless it be of an early variety which is designed for immediate shipment. The fruit as it is picked from the tree is placed in sacks with a hoop in the mouth and a webbing strap to pass over the shoulder to suspend it, as is shown in the engraving. From these sacks the fruit is carefully emptied into barrels which are headed before being removed from the orchard. The pickers in the group shown in Plate XI picked fast enough to keep two men constantly engaged in heading, and three teams busy drawing the barrels to and from the store house, about one-half mile distant. The fruit house upon this place is shown in Plate XIII. It has a capacity for about 10,000 barrels; has two cold chambers in the basement and an ice chest of large capacity in the second story. With such provisions fruit is successfully kept in store until the April or May succeeding picking. Fruit has been preserved in good order in such houses for two years, and Maiden's Blush apples have been kept nearly a year. Good keeping qualities characterize the apples grown in this region. The fruit itself is of high quality, free from wounds, from insects, or defacements by fungi. This, together with careful handling, insures good keeping qualities when proper attention to storing is given. In this respect the practices are somewhat at variance. Some maintain that a frost proof building is preferable to a cold storage room where ice or artificial cold is used. Fruit from the frost proof houses is said to stand longer when placed upon the market. Where ice or other artificial cold is used the chambers are sometimes allowed to become abnormally dry, and as a result the apples shrink, occasionally as much as a peck per barrel. Under such conditions heavy loss is incurred, not only from the loss in weight and bulk, but



PLATE XIII.—Fruit House of Wm. F. and Robt. Brown, Hancock Co., W. Va.
Capacity, 10,000 Barrels.

as well in the quality and flavor of the fruit. Cold rooms should therefore be maintained at normal degree of moisture. For this purpose the inexpensive moisture guages can be profitably used.

Assorting and grading the fruit, as has been stated, is not usually done until after picking and storing is completed. The barrels are then rolled out, unheaded, and the fruit poured upon an assorting box which is built with a slat bottom standing upon a slant, one end being lower, and of a convenient height for working over, and yet high enough so a barrel can stand under the spout. The dimensions are as follows: Side boards are usually made of 10 or 12 inch stuff, and so placed as to give an 8 inch side board, inside measure. The width is 3 feet 3 or 6 inches inside measure, and the slats for the bottom are 4 to 6 inches wide, and are placed about 1 inch apart. The length of the whole is 10 feet; the front legs are usually 2 feet 6 inches long, making the height over all 3 feet 4 inches, while the rear legs are 4 feet 4 inches, raising the top of the side boards 5 feet 2 inches above the floor. A platform is usually built about such machines to facilitate getting the fruit from the barrels into them. The slatted bottom allows all twigs and leaves that may have fallen in among the apples in barreling in the orchard to drop through. The inclination of the bottom facilitates the work of assorting by allowing fresh fruits to roll into the space vacated by those which were rejected or admitted to the barrels. An apron, usually made of a grain sack, is placed across the top of the empty barrel, and when a sufficient number of apples have been rolled upon it to make the facing tier, they are carefully lowered into the barrel and the apron withdrawn until they are placed; the apron is again laid across the open mouth of the barrel and a quantity of fruit is allowed to roll upon it; when sufficiently full the assorted fruits are again lowered into the barrel. This operation is repeated until the barrel is filled sufficiently to admit of the fruit rolling from the assorting box over the apron and directly into the barrel. By this arrangement one handling of the fruit is obviated, or to state it in another way, the fruit is moved by gravity

after once being placed upon the sorter—no more lifting is necessary.

As at present constructed, these devices admit only a single barrel, i. e., only one grade of apples can be placed in a barrel at a time, without picking the fruit out and lifting it into a basket or barrel for that grade. I would suggest that the V-shaped opening by which the fruits are guided into the barrel, be increased from one to two or three, according to the number of grades of fruit desired. That gates be provided at the entrance of these guide-ways, so that the fruit can not be admitted until the person in charge wishes it to roll towards the barrel. By starting the fruit in the direction of the grade to which they belong, all further handling would be obviated. This I realize is an approach to the device used by the orange growers for grading oranges, but if it can be made to subserve the needs of the apple grower, so much the better.

In all operations connected with the preparation and shipment of fruit, care should be taken to keep the packages neat and clean. A tidy looking barrel may be the only point of preference between one consignment and another, yet it may be sufficient to influence a buyer.

Tree Pruning. During the last decade and with the increased acreage of fruit trees, has come a great change for good in the methods of tree pruning. But not as yet has the acme of perfection been reached in this art. To-day trees are headed low, the fruit can be gathered with less labor and less peril to the workmen, and the work of spraying can be easily, quickly and cheaply attended to. The "lackancy" of the present practice is that the individual peculiarities of the variety in hand are not carefully studied. A general scheme for tree pruning is adopted, and while it may be ideal for Ben Davis and Baldwin, it is a source of injury to the Willow or King. In other words, the form and habit of growth of the last two varieties named are so different from that of the others that a different method of pruning should be practiced.

The Willow and King load upon the outside of the tree, and in habit of growth, their branches are long, slender and decum-

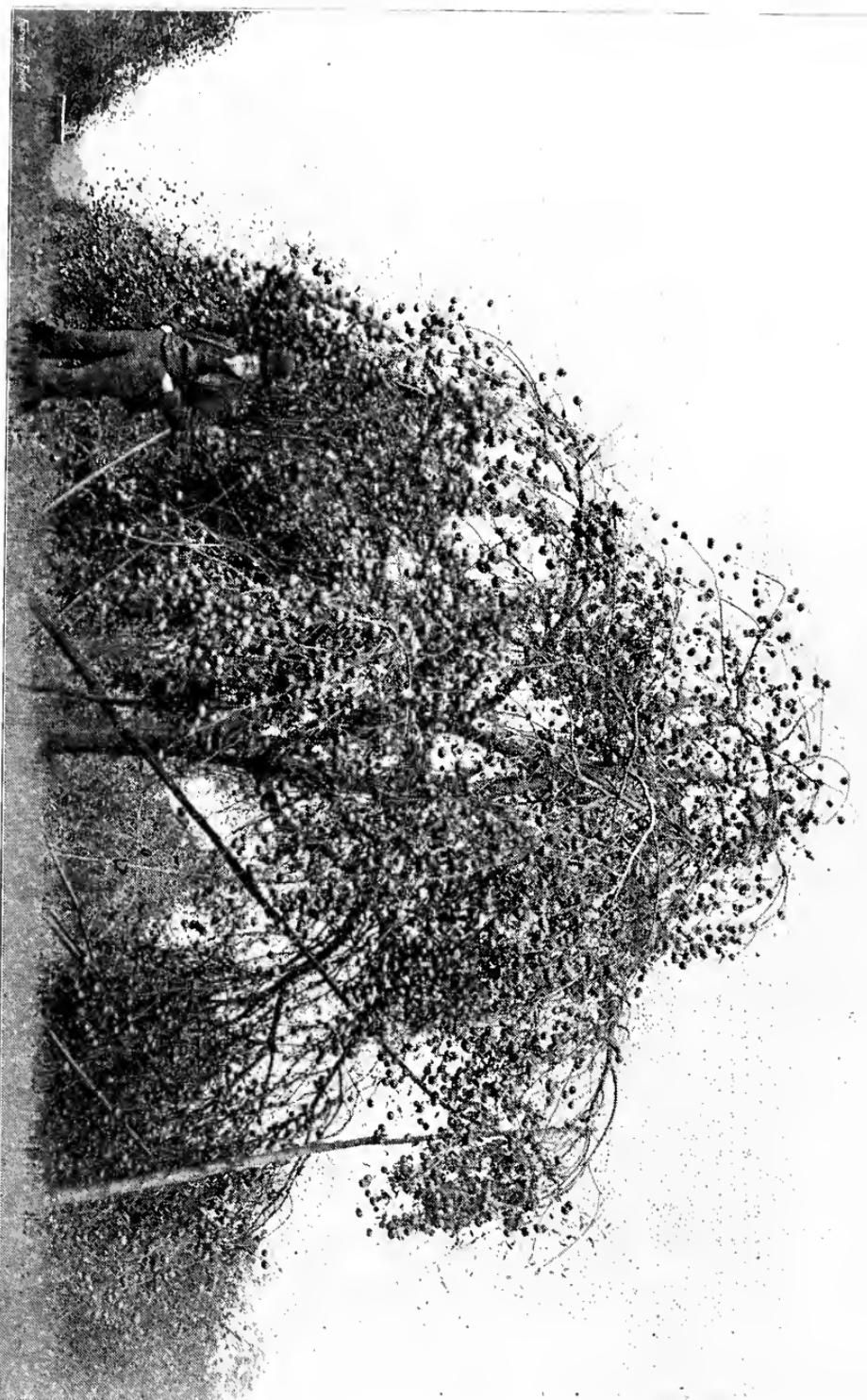


PLATE XIV.—A Propped Tree.

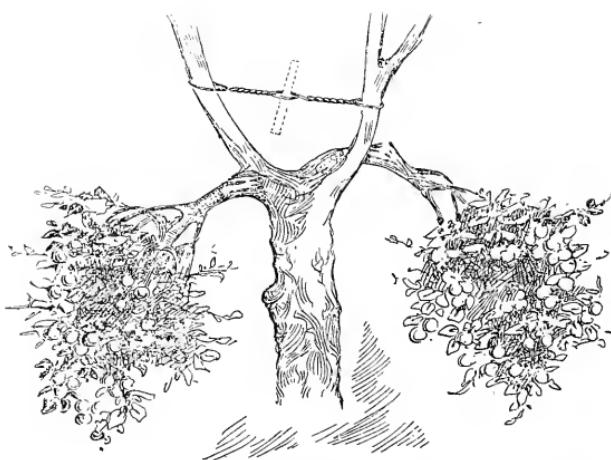


FIG. XV.—Method of Applying and Tightening the Wire.

bent. With a heavy crop of fruit these trees are unusually liable to split down or break their branches, while the Baldwin, Ben Davis and others, with a more compact form and better distribution of fruit throughout the tree, are less subject to such injury. This tendency, in the long, slender branched varieties, it is believed, can, to a large extent, be overcome by a heading in, rather than a too severe thinning practice in pruning. Old trees cannot be readily remodeled, and therefore must be propped, as shown in Plate XIV, or else tied together with wires, as is often done where props are expensive and difficult to obtain. The method of applying and tightening the wire is shown in Figure XV. In using this stay, care must be exercised to have the limbs about which the wire is placed so protected as to prevent girdling. The ideal plan, too, is to have the several guy wires so distributed as to divide the load equally as possible. The wires should be numerous enough to carry the weight of several limbs rather than allowing a single guy about a larger limb to have the load of the several branchlets concentrated upon it. A prop under, or a stay wire about one large limb, is liable to cause the limb to be broken at the point of support. This was impressed upon my mind by the result from the use of props which were rendered so necessary by the excessive crop of the present season.

Spraying. Spraying, for the protection of trees and fruit against insects and disease, while practiced to a considerable extent, has never received the consideration really demanded by such an industry. This is in part due to the comparative immunity from such troubles which the orchards of this section have hitherto enjoyed and in part by an unfortunate experience which many extensive growers had in their first attempts to use Bordeaux Mixture. The results were such as to cause very considerable pecuniary loss, not only in the work of applying the mixture, but also in the way of injury to operatives as well as to fruit.

The men engaged in the work were obliged to discontinue as their hands became sore because of working with the mixture, whatever it was. The foliage of the trees was scalded and the

fruit made russety. This, to my mind, is sufficient proof that the chemicals used were wrongly labeled, or that they were improperly combined. The only clue I have been able to obtain up to this time is this: that one of the ingredients used is spoken of as "the strongest vitriol ever brought into the section." This was the remark of one of the telegraph operators of the Pa. R. R. Whether this word "vitriol" applies to blue stone or to the oil of vitriol I am at a loss to know, but judging from results I feel that oil of vitriol or sulphuric acid must have been used instead of blue vitriol, or copper sulphate, as should have been. The only other explanation lies in the idea that the foliage of the varieties sprayed is tender and susceptible to injury by the mixture. This is again very doubtful if the dilute mixture is used. Slight injury to both fruit and foliage is known to result from the use of the dregs of the spraying vessel, or when, too concentrated a solution has been used.

None of these explanations except the one that sulphuric acid has been used is sufficient to explain all the bad results noted. This question will receive careful attention from the Experiment Station, and the proper solution of the difficulty may be looked for in a future publication.

Varieties. In all large industries only a few lines of work are engaged in. In large orchard enterprises, wherever they are found, the same rule is observed. A few varieties are selected with special reference to the soil and locality and also to the extent of the business and the market to be supplied. In general, three varieties are all that the grower can possibly handle. Under peculiar circumstances the list may be somewhat extended, but ordinarily three or less is enough. When the grower is at a distance from his market, and when he depend mainly upon winter or keeping varieties of fruit, few, rather than many kinds, should be selected. In each apple region some one variety seems to gain the ascendancy in favor, and the largest acreage of any one sort is always given to this variety. In New York the Baldwin is monarch; in Missouri the Ben Davis holds supremacy; in Virginia the New Town Pippin is the favorite; while in West Virginia the Willow is

supreme in the northern Panhandle; and the Rome Beauty is the favorite farther south. Besides the Willow Twig, the Ben Davis and the Baldwin have a considerable acreage in certain portions of the Hancock county apple belt. While this is but a limited number of the varieties actually found in the section, they are those that are considered of greatest economic value.

As regards natural advantages the fruit belt of Hancock county is unusually favored. The soil, climate and exposures are well suited to the apple. The means of transportation are good, the river serves to put the producer in cheap and easy communication with the cities of middle and southern United States, while the Pennsylvania R. R. system affords a quick route to the eastern seaboard cities.

At present only one accessory or co-ordinate industry is lacking in this section, and that is the evaporator. A large vinegar factory consumes a goodly percentage of the "drop apples," but the price paid for such fruit to manufacture into vinegar cannot be what it would be for the best of that class for evaporating. With this one addition the methods, both from a scientific and economic standpoint, might well be taken as a pattern by others in apple growing-regions.

THE LONGEVITY OF FRUIT TREES.

The causes affecting the length of life of our common fruit trees, particularly the apple, were very fully discussed by Prof. Bailey in a paper read before the Horticultural Society, of Kansas, in 1890. These causes were classified under two heads with their co-ordination or sub-divisions, viz. :

I. Extra Cultural Causes.

1. Change in Climate.
2. Greater Abundance of Insects.
3. Greater Abundance of Fungi.

II. Cultural Causes.

4. Lack of Adaptation of Varieties to Conditions.
5. Forceful Methods of Culture.
6. Lack of Fertility and Neglect.
7. Methods of Propagation.
8. Pruning.

Without further comment upon the very able paper of Prof. Bailey, I desire to supplement his statements upon the 4th and 7th topic, i. e., Lack of Adaptation of Varieties to Conditions or Environments and also Methods of Propagation.

Varieties of cultivated fruits, which are propagated by artificial methods, such as budding and grafting, are to be considered as individuals in this discussion, for, like plants propagated by division, they are all portions of the one original specimen, and like it possess its individual characteristics. We know that no two trees growing naturally from seed present the same characters. They differ widely in constitution. Since then, varieties are to be considered as individuals, we shall speak of class differences in an individual manner.

While I am not an advocate of, or a firm believer in, the theory of correlation of characters, we do find that some of our most desirable and most highly refined fruits present weaknesses in their constitution which either lessens fruit production or shorten the life of the plant to such an extent that the cultivation of the variety is rendered hazardous or hardly remunerative. In central New York apricot culture is greatly limited by the weakness manifest in the trunk of the tree. When top worked on the plum, however, this difficulty is overcome, and the trees return paying crops. Some of the most profitable plums of the Reinclaude type are looked upon with distrust by many growers because of the short life of root-grafted trees. The injury does not occur to the buds or branches, but to the trunk. Its bark splits open, causing an extreme flow of sap and a corresponding secretion of gum. The drying and fermentation which follows weakens the tree and causes premature death. This difficulty is again overcome by a system of double working. Young root-grafted or budded Lombard trees, or those of some other hardy variety are selected and top-grafted with the Reinclaude. This places the desirable yet weak trunked variety upon a solid foundation. Some varieties of American plums show this weakness in the trunk, and are, therefore, short-lived and not sought by growers. The Harrison Peach is one of this class. Varieties which are truly desirable

should not, however, be allowed to become extinct because of this fault. Double working or top working should be adopted for them and their good qualities preserved.

From results obtained by A. Carpenter & Sons, of Vermillion, S. D., and by myself while at the South Dakota Station, I am confident of a future for some of the Japanese and European varieties of plums, even in the northwest, when they are worked upon native stocks. The Lombard, Moor's Arctic and German Prune among Europeans, and the Williard among the Japanese sorts, succeeded at the South Dakota Station. The Lombard and German Prune were crown worked ; the Moor's Arctic was both crown and top worked, and the Japanese variety was top worked.

While this method of increasing the longevity of some of the above named fruits has been practiced, it, so far as I am aware, has not attracted the attention of the apple grower. But it can be made profitable.

In the apple growing region of New York, as well as in our own State of West Virginia, the King—while one of the most desirable and most highly remunerative varieties—is condemned as short-lived. This will become more and more emphatic as the orchards that are now just coming to their prime begin to show age, and as soon as the old top-grafted trees have all disappeared. Convincing proof of this has recently fallen under my notice. In an orchard owned by Mr. Jas. Carmichael there are now standing King trees which were top worked upon seedlings dug from the fence row. The scions were cut from root-grafted trees set at the same time as, and in the same orchard with, the aforesaid top worked trees. The orchard is now twenty years of age, and the root grafted King apple trees have all been dead for ten years or more, while the top worked trees are to-day in a fairly good condition. In this State root-worked Kings present the same weakness shown by the Reinclaude and other varieties of plums in New York. In an orchard in New York which is now about twenty-six or twenty-eight years of age, the Kings, out of a half dozen varieties, are the only ones that are dying, and

several have succumbed from apparent loosening of the bark, in the last three years. From the example presented by the orchard of Mr. Carmichael, I am convinced that the longevity of the King apple can be greatly enhanced, and that growers need have no hesitancy in planting this variety extensively, if it be double worked, or even top worked.

The King has been made the subject of special comment in this connection because of its high commercial rating in the apple regions of New York. It is not the only variety, however, from which we have such testimony as the above. In the same orchard ten root grafted and ten top worked specimens of the Walldow were set at the same time, the scions for the top grafted trees being cut from the nursery grown trees at time of planting. At the present writing, twenty years after planting, all the top grafted trees are living and in a thrifty condition. The root grafted specimens are all dead except one limb of one tree. These trees began to die at five years from time of setting, and not more than three were alive at ten years from that date. Of seven root worked Kings all are dead, while seven top grafted trees of that variety are all good. The Golden Russet also shows nearly the same record; and for the whole orchard in which one hundred root grafted trees were set, there are sixty-six now living; while of seventy top worked trees on the same soil, with like exposure and treatment, sixty-five trees are yet doing well. This gives us 44 % loss for root propagation against 72 % for the top worked trees.

By double working, a more uniform orchard can be obtained than by top working alone. For this purpose no better variety can be selected than the Tallman Sweet. It possesses a close, smooth bark, a strong yet not rapid growth and a great length of life.

The question of propagating these tender varieties is not then a controversy as to the superiority of whole root, piece root, or budded trees, and if it were, in all cases, it seems to me, preference should be given to the piece root grafted tree. The piece root tree induces the formation of roots from the scion itself. And, if there is any advantage in plants upon their own

roots, cutting plants and piece root grafted plants should have the preference.

After carefully inspecting a number of root grafted trees, there is little doubt in my mind as to the superiority of root grafted trees for those varieties having strong trunks and for such varieties for double working. Root grafted trees when worked on pieces of roots, can at transplanting time be placed on their own roots by simply pruning away the original root and leaving only the roots that have grown from the scion itself. In this way, all objectionable features that might arise from the original seedling from which the piece root was taken, will be overcome. For varieties with tender trunks, root grafting as well as budding is not desirable ; but for hardy varieties the danger of being worked on a tender root is overcome by piece root grafting more completely than by any other system of artificial propagation.

But it is not our purpose to discuss the merits or demerits of any particular style of propagation. It is rather to set forth what we believe to be a remedy for a great menace to the profitable culture of varieties of fruits, showing weakness in the trunk. By double working, or by top working alone, many now almost discarded varieties may be restored to the list of profitable sorts.

If such practices are capable of preserving the grape industries of Europe, why should we not take equal interest in them for the preservation and extension of *our* fruit interests ?



